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$18\frac{6}{13}$ minutes past 10, $13\frac{11}{13}$ minutes past 11, $9\frac{3}{13}$ minutes past 12, $4\frac{8}{13}$ minutes past 1, 2 o'clock, $4\frac{8}{13}$ minutes to 3, $9\frac{3}{13}$ minutes to 4, $13\frac{11}{13}$ minutes to 5, $18\frac{6}{13}$ minutes to 6, and $23\frac{1}{13}$ minutes to 7.

Also solved by ***JOSIAH H. DRUMMOND***, ***P. S. BERG***, ***ELMER SCHUYLER***, ***H. C. WHITAKER***, and ***J. SCHEFFER***.

129. Proposed by J. W. DAPPERT, Civil Engineer and Surveyor, Taylorville, Ill.

"A Minion, agile, in stature small
Panting came to great Diana's Hall,
Bearing a marble globe upon his shoulders,
Measuring one inch in its diameters.
He rolled it to the northeast corner of the Hall,
Left touching the northern and eastern walls;
Then following came three demi-gods in white,
Each bearing a globe of lustrous metal bright;
One of iron, copper one, and one of silver;
And they placed them in the order given,
Touching each the other, and at the same time,
Touching each the side walls, in a direct line,
The iron touching the marble, and its other side
Resting against the silver, in its glory and pride,—
All resting upon the oaken floor; and then
With heavy tread, and puff, and roar, Atlas came
Bearing a huge golden sphere, that filled the Hall,
Touching the four sides, floor and ceiling, and all
Radiant with beauty, resting against the silvery ball,
Making the globe's diameters in the room diagonal."

"Tell me, all ye who mathematics know:
What size the copper sphere, and oh!
How large the iron globe? How great
The golden globe; immaculate?
The silver sphere, how great? What size?
And if presented as a prize,
What value do you hold
Would be the sphere of gold?"

Solution by M. A. GRUBER, A. M., War Department, Washington, D. C.

A cube, in form, is great Diana's Hall:
The massive sphere of gold, admired by all,
With ceiling, sides and floor in contact is.
Within the northeast corner's boundaries
Are found the other spheres, in number four,
Each tangent to the corner's sides and floor;
Besides, the sizes of the sphere are such
That each one with its neighbor is in touch.
The order, as they to the corner rolled,
Was marble, iron, copper, silver, gold.
The hall's dimensions, length and breadth and height,
And golden sphere's diameter are quite
The same in measurement; let this be b.
The hall's diagonal, which we'll name c,
Is quickly found *b times square root of 3.* [$b\sqrt{3}$]
The points of contact of the spheres we find
Are in the hall's diagonal confined;
So, too, the centers of the spheres are there.
If hall with golden sphere we now compare,
Outside the sphere are equal ends of c;
And, known as d, each end is found to be
Square root of 3 less one times half of b. [$\frac{1}{2}b(\sqrt{3}-1)$]
The ratio of diameters to find
Of tangent spheres, must next be borne in mind.
Take a as silver sphere's diameter;

Then *d* is found to equal, we aver,
Square root of 3 plus one times half of a. [$\frac{1}{2}a(\sqrt{3}+1)$]
Equating *d*'s two different values, weigh
Results, and see *square root of 3 plus 2.* ($\sqrt{3}+2$]
Of *b* to *a* the ratio, come to view.
This ratio known as *t*; then find it true
That of diameters of any two
Contiguous spheres within the corner's space
The ratio is the self-same *t*, a case
Of beauty mathematical. We now
From demonstrations rest the knitted brow,
And the diameters of all the spheres
Announce. Within the problem it appears
That the diameter of marble sphere
Is just *one inch*. From ratio *t* 't is clear
That iron sphere's diameter is *t*;
Then that of copper sphere *t squared* must be;
Whence that of silver sphere is *cube of t*;
And the diameter of golden sphere
As *t involved to fourth power* must appear.
Three hundred seventy-three as hundredths is
The value of the ratio *t*; and this [$t=3.73+$]
To powers second, third and fourth involved,
Yields as results, approximately solved, [13.92+]
Nine tenths to thirteen added, fifty-two, [51.98+]
And ninety-seven multiplied by two. [193.99+]

The golden sphere is wondrous as to size;
And in regard to value as a prize,
Not all our country's golden output coined
In her existing years, together joined,
Could purchase its great worth. In numbers round,
Eight hundred four of millions will be found
The dollars that in purest gold abound
In this great sphere. Besides it would confound
The efforts of the mind that should aspire
To measure the extent of thinnest wire
To which there might be drawn this golden mass.
From Earth to Sun this slender thread could pass,
Return again to Earth, and eight times more
The circuit make, and still have end galore
To stretch from Earth to Moon strands eighteen score.

ALGEBRA.

104. Prize Problem. $2.50 for the best solution.

Compute to three decimal places each of the roots of the equation $x^2+y=2$, $x+y^2=6$.

I. Solution by AGNES E. SCHEFFER, Hagerstown, Md.

From the first of these equations we have $y=2-x^2$, and substituting this in the second, we have $x^4-4x^2+x-2=0$.

Factoring we have $x^2(x^2-4)+(x-2)=0$, or $(x-2)(x^3+2x^2+1)=0$.

$\therefore$ $x-2=0$, and $x^3+2x^2+1=0$.

From the former we obtain $x=2$ and then its simultaneous value $y=-2$, obtained from the first of the original equations.

By solving the cubic equation $x^3+2x^2+1=0$, we obtain three more roots for x.